UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

VIA FACSIMILE - 805-644-3958
AND U.S. MAIL

Ms. Diane Noda
Field Supervisor
U.S. Fish and Wildlife Service
2493 Portola Road, Suite B
Ventura, CA 93003

Subject: Request for Concurrence with EPA Finding of "No Likely Adverse Effect" Pursuant to Section 7 of the Federal Endangered Species Act for the Continued Ocean Discharge from the Morro Bay/Cayucos Wastewater Treatment Plant

Dear Ms. Noda:

The U.S. Environmental Protection Agency (EPA) is proposing to reissue an ocean discharge permit to the Morro Bay/Cayucos Wastewater Treatment Plant (Morro Bay/Cayucos), which authorizes the continued ocean disposal of municipal wastewater that does not meet federal secondary treatment standards. Pursuant to section 7 of the Endangered Species Act (ESA), EPA's proposed action requires consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), which are charged with the protection of federally listed endangered and threatened species and designated critical habitat that may be affected by the proposed action. EPA has already concluded informal consultation with NMFS for this action with respect to federally listed species and critical habitat within NMFS' jurisdiction.

Based on review of the best available scientific and commercial data, EPA has determined that the continued wastewater discharge from Morro Bay/Cayucos is not likely to adversely affect the brown pelican or southern sea otter, both of which occur in the vicinity of the subject discharge. The tide-water goby and least tern were also considered in EPA's determination, but neither animal was found to occur, nor is either reasonably expected to occur, in the vicinity of the discharge or action area (as defined in ESA regulations), and therefore EPA finds that these species will not be affected by EPA's action. The enclosed Biological Evaluation

(BE) summarizes EPA's review and findings, which support EPA's conclusion that any potential direct or indirect effects of the continued wastewater discharge would be insignificant to the brown pelican and southern sea otter.

During the development of EPA's BE, USFWS staff requested information relative to the subject discharge's potential role in causing and/or contributing to local occurrences of toxoplasmosis (via cat faeces) in the southern sea otter and domoic acid toxicity (i.e., red tides). During EPA's investigation, which included discussions with leading experts on these topics, EPA found no credible scientific information to support the conclusion that the subject wastewater discharge is a significant source causing toxoplasmosis in the local sea otter population or domoic acid toxicity. Further, EPA's investigation has revealed that a scientifically acceptable method for measuring *T. gondii* oocysts, which cause toxoplasmosis in animals, from wastewater and surface waters (such as streams, lakes and oceans) has yet to be developed. However, EPA's investigation has also determined that the subject wastewater discharge cannot be entirely ruled out as possibly having some minor influence or contribution to these environmental perturbations. Therefore, the following conservation measures have been proposed by EPA to minimize the likelihood of any possible adverse effects to listed species:

1) Public outreach program to minimize the input of cat litter-box wastes into the municipal sewer systems;

2) Regular monitoring of nutrient loading from the facility's ocean outfall; and

3) Facility upgrade to at least full secondary or tertiary treatment by 2014.

These measures have been agreed to by both the applicant and the Regional Water Quality Control Board, Central Coast (RB3), and will be incorporated as conditions of the joint discharge permit to be issued to the applicant by EPA and RB3. With regard to facility upgrade, both the Morro Bay/Cayucos Sanitary District (on May 24, 2007) and Morro Bay City Council (May 29, 2007) unanimously moved that the subject facility be upgraded to meet tertiary standards with the intention to move toward reclamation within the specified timeframe.

With the incorporation of the measures listed above, EPA finds, under section 7 of the ESA, that the continued wastewater discharge from the Morro Bay/Cayucos Wastewater Treatment Plant is not likely to adversely affect listed species or critical habitat, in accordance with 50 C.F.R. §§ 402.13 and 402.14(b). I am writing to request written concurrence from USFWS with this finding.

If you have any questions regarding this request, please contact Mr. Aaron Setran of my staff at (415) 972-3457.

Sincerely,

Alexis Strauss 6 Sept. 2007
Alexis Strauss, Director
Water Division

Copy w/ Enclosure:
Bruce Keogh, City of Morro Bay, Public Services, 955 Shasta St., Morro Bay, CA 93442

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Endangered Species Act Biological Evaluation

Morro Bay/Cayucos Wastewater Treatment Plant

Prepared by: U.S. EPA Region IX

September 2007

Findings

The U.S. Environmental Protection Agency (EPA) is proposing to reissue an ocean discharge permit to the Morro Bay/Cayucos Wastewater Treatment Plant (Morro Bay/Cayucos), which authorizes the continued ocean disposal of municipal wastewater that does not meet federal secondary treatment standards. Pursuant to section 7 of the Endangered Species Act (ESA), EPA's proposed action requires consultation with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS), which are charged with the protection of federally listed endangered species and designated critical habitat that may be affected by the proposed action.

Based on review of the best available scientific and commercial data, the Environmental Protection Agency Region IX (EPA) has determined that the continued wastewater discharge from the Morro Bay/Cayucos facility is not likely to adversely affect the brown

pelican or southern sea otter, both of which occur in the vicinity of the subject discharge. EPA finds that any potential direct or indirect effects of the continued wastewater discharge would be insignificant to the brown pelican and southern sea otter. The tide-water goby and least tern were not considered for this assessment as these animals have not been found to occur, nor are they expected to occur, in the vicinity of the discharge or the action area, as defined in ESA regulations.

Background

The Morro Bay and the Cayucos Sanitary District ("the applicant") has requested re-issuance of a permit under section 301(h) of the Clean Water Act, 33 U.S.C. section 1311(h). Such a permit, or 301(h) waiver, allows for the ocean disposal of wastewater from a publicly owned sewage treatment plant that is not required to meet federal secondary treatment requirements, as contained in section 301(b)(1)(B) of the Act, 33 U.S.C. section 1311(b)(1)(B). The 301(h) waiver is being sought for the Morro Bay-Cayucos Wastewater Treatment Plant, which is a publicly owned treatment works (POTW).

In California, National Pollutant Discharge Elimination System (NPDES) permits are generally issued by the California Regional

Water Quality Control Boards, which also administer the California Porter-Cologne Act. However, the Clean Water Act provides that EPA must issue any permits authorized under section 301(h) of the Act. The applicant's request for continuance of its 301(h) waiver must be authorized via a NPDES discharge permit issued by EPA and Waste Discharge Requirements issued by the Regional Water Quality Control Board, Central Coast ("RB3"), pursuant to the Porter-Cologne Act. Re-issuance of the waiver and permit would continue to allow the applicant to discharge treated wastewater to the Pacific Ocean that is not required to meet otherwise applicable federal secondary treatment standards.

The applicant received its first 301(h) waiver from the EPA and RWQCB in March 1985 (Permit No. CA0047881). This original permit expired in March of 1990 and has been reissued by both EPA and the RWQCB twice since, in March 1993 and March 1999. The current permit expired on March 1, 2004, and has been administratively extended until a final decision regarding the applicant's request for re-issuance of the waiver has been made. EPA issued its Tentative Decision Document (TDD) regarding the applicant's current application for permit renewal on November 10, 2005. In the TDD, EPA proposes that the applicant be allowed to retain its 301(h)

permit contingent upon the satisfaction of the following conditions, and that the applicant's NPDES permit be renewed in accordance with the applicable provisions of 40 CFR Parts 122-125. The TDD provides that the applicant's renewal of a section 301(h) waiver is contingent upon:

1. Implementation of the approved monitoring program upon issuance of the renewed 301(h) modified permit [40 CFR 125.63].

2. The California Coastal Commission determination that the applicant's proposal is consistent with the relevant State Coastal Zone Program [40 CFR 125.59(b)(3)].

3. Findings from the USFWS and NMFS that operation of the discharge will not adversely impact threatened or endangered species or critical habitats pursuant to the ESA [40 CFR 125.59(b)(3)].

4. Final concurrence from RB3 on the approval of a section 301(h) variance [40 CFR 125.59(i)(2)].

EPA's recommendation in the TDD for reissuance of the waiver is

based in part on review of the scientific information collected by the applicant over the last two decades, which relates to the applicant's ocean discharge and its potential impact on the local marine environment.

Recently, the applicant and RB3 have agreed to a multi-year infrastructure development and implementation plan which will provide for full secondary or tertiary treatment of the facility's wastewater prior to ocean disposal and/or water reuse. The applicant has requested that EPA continue to evaluate and consider the ocean waiver reapplication, as it would be several years before the applicant could achieve advanced treatment. Until the applicant can provide advanced treatment for all the influent wastewater, it would need to operate under a 301(h) waiver.

EPA has proposed the following conservation measures to minimize the likelihood of any potential adverse effects from its proposed action to federally listed species:

1. Public outreach program to minimize the input of cat litter-box wastes into the municipal sewer systems;

2. Regular monitoring of nutrient loading from the facility's ocean outfall; and

3. Facility upgrade to at least full secondary or tertiary treatment by 2014.

These measures have been agreed to by both the applicant and RB3, and will be incorporated as conditions of the joint discharge permit to be issued to the applicant by EPA and RB3. With regard to facility upgrade, both the Morro Bay/Cayucos Sanitary District (on May 24, 2007) and the Morro Bay City Council (on May 29, 2007) unanimously moved that the subject facility be upgraded to meet tertiary standards with the intention to move toward reclamation within the specified timeframe.

Facility History and Operation

The treatment plant currently provides full primary and partial secondary wastewater treatment for a service population of about 13,800. The plant was originally built in 1954 and expanded in 1964. A new outfall was constructed and came into operation in 1982. The current application is based on an average dry-weather flow of 2.06 million gallons per day (MGD). The treatment plant

discharged an annual average of just over 1.0 million gallons per day for 2005 and 2006, respectively. Based on the definition in 40 CFR 125.58(c), the applicant is considered to be a small discharger.

The current treatment system includes primary treatment of all influent by screening, grit removal and primary sedimentation. In addition, a major portion of the primary effluent receives secondary treatment on a daily basis in order for the final effluent (primary plus secondary) to meet California's minimum requirement of 75 percent solids removal. The secondary treatment process consists of parallel single-stage, high-rate trickling filters whose combined wastestream flows to a solid contact channel, and then to a secondary sedimentation tank. The effluent from the secondary treatment process is combined with that portion of primary effluent which does not receive secondary treatment before discharge to the ocean. The final, blended wastestream (i.e., primary plus secondary) is disinfected with chlorine prior to ocean discharge, which occurs by way of an outfall/diffuser system. The terminus of the outfall is located approximately 1.75 kilometers (1.25 miles) north of Morro Rock, and one kilometer (0.6 miles) from the Atascadero State Beach shoreline.

The average annual effluent concentration for Suspended Solids (SS) at the subject facility between 1998 and 2005 was 37.4 mg/L. Average removal efficiency for SS over the same time period was 88 percent; the California Ocean Plan requires at least 75 percent removal (as a 30-day average) as a minimum threshold for ocean dischargers, and 85 percent removal of SS (as a 30-day average) for purposes of meeting secondary treatment standards. The annual average Biological Oxygen Demand (BOD) concentration in the effluent between 1998 and 2005 was 53.5 mg/L. The removal efficiencies for BOD by the subject wastewater treatment plant during this same time period averaged 82 percent; the California Ocean Plan does not specify treatment-based effluent limits for BOD, but does require at least 85 percent removal of BOD (as a 30-day average) for secondary treatment standards. The facility has been achieving BOD removal efficiencies greater than 80 percent since 1992. Given the removal efficiencies for SS and BOD, the subject facility is discharging effluent that is extremely close to meeting California secondary treatment standards.

In terms of mass loadings of suspended particulate matter from the subject facility to the marine environment (measured in tons),

suspended solids have ranged from 42 to 74 metric tons per year (MT/yr) between 2001 and 2005. Given the small projected increases in population for the service community, loadings are not likely to increase substantially over the next decade. The annual mass emissions limit in the applicant's existing permit is for 199 MT/yr and, as reported, the applicant's loadings to the receiving waters have consistently been well below this limit.

The applicant states that "over the next five years, no downgrading of effluent quality is anticipated given the limited projected growth in population and industry in the service area." The applicant is not requesting or proposing to increase the amount of mass loadings of SS in its current application.

For more detailed information regarding the subject facility's history and operation, please see EPA's TDD.

Endangered Species

As indicated in EPA's TDD, 40 CFR 125.59(b)(3) provides that issuance of a 301(h) modified NPDES permit must meet requirements under the ESA. The southern sea otter (*Enhydra lutris neris*) and brown pelican (*Pelecanus occidentalis californicus*) are those

federally listed endangered species that occur in the vicinity of the subject discharge and fall under the regulatory responsibility of the USFWS. Steelhead (*Oncorhynchus mykiss*), which likely occur in the vicinity of the discharge on a seasonal basis, is an anadromous fish species that is federally listed as endangered and is under the regulatory authority of the NMFS; the applicant has obtained written concurrence from NMFS, dated August 12, 2003, that steelhead are unlikely to be adversely affected by the discharge due to their migratory and free-swimming nature.

In 1983, EPA designated the applicant as non-Federal representative to USFWS and NMFS to conduct informal consultation on the potential impact of the Morro Bay/Cayucos discharge on endangered species under section 7 of the ESA. For the original 1985 permit, consultation under the ESA with USFWS and NMFS was concluded informally based on the transitory nature of the gray whale (which was delisted in 1994) and southern (or "California") sea otter, and the lack of toxic pollutants and pesticides associated with the applicant's discharge that could affect the health of the California brown pelican and American peregrine falcon (which was delisted in 1999). Both federal agencies reaffirmed their position with regard to the potential effect of the subject discharge on

federal endangered species for the 1993 and 1999 re-issued permits for this facility.

In a letter dated March 17, 2006, the USFWS informed the applicant that EPA is responsible for determining whether endangered species will be adversely affected by the subject discharge, as the lead federal agency that would authorize or permit the subject discharge. As mentioned above, the brown pelican and southern sea otter are the two endangered species under the jurisdiction of USFWS that occur in the vicinity of the discharge, ~~and~~ which therefore may be affected by the discharge.

Brown Pelican

Background

Because the subject facility qualifies as a small discharger, pursuant to 40 CFR 125.58(c), with a limited potential for adverse biological impact, sampling of fish, birds, and mammals occurring in the vicinity of the discharge was/is not required as part of the applicant's monitoring program. Therefore, no biological data on fish, birds and mammals has been provided to EPA in the 301(h) waiver application by the applicant for permit renewal purposes.

Two sub-species of the brown pelican inhabit North America: the California brown pelican and the Eastern brown pelican (*Pelecanus occidenta carolinensis*). Both sub-species are endangered, although the eastern brown pelican has been "delisted" in a number of East coast states (Alabama, Florida, Georgia, and the Carolinas). The California brown pelican occurs along the Pacific coast from Chile to California, and to coastal sections of Oregon and Washington. This bird species prefers coastal offshore islands for nesting purposes and, in general, must be in the absence of terrestrial predators and human disturbance for breeding/reproductive purposes.

Brown pelicans require sufficient food supplies, primarily marine fishes, whose abundances can be influenced by commercial fishing and naturally-occurring fluctuations in ocean water temperatures. A decline in the numbers of the brown pelicans in the 1950s, 60s and 70s was primarily related to exposure to organochlorines (such as DDT) through the consumption of contaminated fish. Exposure to organochlorines causes the shells of bird eggs to be thinner than normal, causing the eggs themselves to be more susceptible to crushing during incubation by the parent birds; most bird species exposed to DDT, either directly or indirectly, show similar

problems. Consequently, pelican numbers declined dramatically until federal and international prohibitions on the use of such pesticides was put into place during the 1970s and 1980s. Along with the development/designation of additional habitat and refuge areas for the pelican, the ban on the use of organochlorines has led to a recovery of both pelican sub-species to self-sustaining levels; the USFWS has recently proposed "delisting" the California brown pelican, which is currently open for public comment.

Potential For Effect

Brown pelicans undoubtedly occur in the area of the outfall at various times, and are therefore potentially exposed to wastewater constituents from the discharge, at some level. Additionally, the prey of pelicans (i.e., marine fishes) could potentially be exposed to wastewater constituents as they can occur near the outfall. However, consideration of the following factors lessens the likelihood that the facility's discharge presents a reasonable potential to adversely affect local pelican populations and their prey:

1) The transitory nature of pelicans and pelican prey, which precludes the likelihood that these organisms are

subjected to wastewater (and its constituents) for periods of time sufficient enough to cause discernable adverse effects;

2) The small volume of the subject discharge (1.1 MGD) relative to the vastness and physical dynamics of the immediate discharge environment;

3) The dilution capacity of the discharge environment or Zone of Initial Dilution-ZID (1 part of wastewater to 133-250 parts ambient water);

4) The limited and relatively small area of the ZID boundaries, which is approximately 45 feet from the outfall in all directions;

5) Discharge monitoring data, which indicate low concentrations and/or absence of toxic constituents in the facility's effluent and from sediments collected in the vicinity of the outfall; and

6) The lack of any evidence or data to indicate that the community structure of benthic invertebrates living in sediments near the outfall are significantly different from those living outside the influence of the discharge. Such evidence would indicate that the wastewater discharge may be adversely affecting the ecosystem in the

vicinity of the outfall.

EPA's search of current and historic information (scientific and commercial) has yielded no studies or data to indicate that the wastewater discharge from the subject facility has had a detrimental impact on the California brown pelican. In addition, EPA is not aware of any information that indicates that the subject facility has any reasonable potential to adversely affect the California brown pelican.

Based on the above information, it is EPA's determination that the continued wastewater discharge from the Morro Bay/Cayucos Treatment Plant is not likely to adversely affect the California brown pelican. This finding by EPA is consistent with previous USFWS determinations (1985, 1993 and 1998) for the subject facility.

Southern Sea Otter

Background

Over fifty scientific publications and journal articles concerning the biology and ecology of the southern sea otter were reviewed by EPA in preparation of this document. Many of these articles have

been listed as "sources" at the end of this document. Several of these articles provide complete and up-to-date information on the overall health of the southern sea otter population and its environment, and also provide a discussion of the current understanding of the various diseases/pathogens causing mortality in sea otters. These articles include:

"Southern Sea Otter as a Sentinel of Marine Ecosystem Health" by Jessup et.al. EcoHealth 1, 239-245 (2004).

"Population Dynamics and Biology of the California Sea Otter at the Southern End of Its Range; Final Study Report" by U.S. Dept. of Interior, Mineral Management Service, MMS 2006-007.

"Transmission of Toxoplasma: Clues from the study of sea otters as sentinels of *Toxoplasma gondii* flow into the marine environment" by P.A. Conrad et.al. International Journal for Parasitology 35 (2005) 1155-1168.

"Patterns of Mortality in Southern Sea Otters (*Enhydra lutris nereis*) from 1998-2001" by C. Kreuder et. al. J. of Wildlife Diseases, 39(3), 2003, pp. 495-509.

"Coastal freshwater runoff is a risk factor for *Toxoplasma gondii* infection of southern sea otter (*Enhydra lutris nereis*)" by M.A. Miller et.al. International Journal for Parasitology 32 (2002) 997-1006.

"Biological analysis of sea otters and coastal marine ecosystems in Central and Southern california: Synopsis and update" White Paper by J. Estes et.al., 31 March 2006. 17 pages.

"Detection of Toxoplasma gondii oocysts in cat feces and estimates of the environmental oocyst burden in a California coastal community" Submitted for publication to Journal of American Vet. Med. Assoc. by H.A. Dabritz et.al., March 2007.

For purposes of understanding the underlying basis supporting EPA's ESA determination for the southern sea otter (presented herein), EPA suggests that, at a minimum, these seven articles be reviewed in concert with this document.

Population History and Trends

Sea otters, from Japan to the Aleutian Islands and down the west coast of North America, from Alaska to Baja, were hunted for their fur to near extinction during the 18th and 19th Centuries. International treaty agreements (established in 1911) prohibited the continued hunting of sea otters (and fur seals) from these regions because so few animals remained. By the time the treaty agreements pertaining to sea otters were enforced it is thought that less than 2,000 individual sea otters remained worldwide.

Based on differences in color, body size, and skull size, some taxonomists believe that three sub-species of sea otters occurred worldwide: *Enhydra lutris lutris*, "the Commander-Aleutian North American sea otter"; *E. l. gracilis*, "the Kuril-Kamchatka sea otter"; and *E. l. nereis*, "the southern California sea otter". Other taxonomists suggest that these three subspecies only constitute "races" within the same species. Currently, two sub-species are generally recognized, and are geographically distinct: *E. l. lutris* which mostly occurs off Alaska and the Aleutian Islands, and *E. l. nereis*, which mostly occurs along the central California coast.

It is believed that the extant southern sea otter population is

descended from a remnant population of about 50-300 individuals from the Big Sur coastline. Because of this, some scientists believe that the current California population lacks sufficient genetic diversity which would, under normal circumstances, enable robust population growth and expansion within historic ranges during the period since treaty protection. Relative to the Aleutian Island population, abundance trends for the southern sea otter have failed to meet growth and expansion expectations. According to those who study the southern sea otter, pollution, habitat loss, disease, and fishing net entanglement are some of the main causes affecting the extant population of otters along the California coast.

Based on current population densities of the southern sea otter, and available habitat and resources, population biologists believe that approximately 16,000 individual otters occurred (at one time) within their historic geographic range. Otter abundances and occurrences along the California coast have been monitored by government and academic researchers since at least the 1970s. Biannual otter counts have been conducted by the US Dept. of Interior (USFWS and USGS) since 1982. Experts estimate that today there are approximately 2,700 otters living in coastal waters.

between Half Moon Bay and Point Conception. Recent sightings of individual sea otters beyond these areas have been reported as far north as Pt. Reyes, and as far south as the Baja Peninsula.

In general, the southern sea otter population has slowly increased since the 1920s at about a five percent (5%) rate increase per year up until the mid-1990s. In comparison, the sea otter population of the Aleutian Islands has increased at about a twenty percent (20%) rate per year during this same period. Although southern sea otter populations have expanded beyond the Big Sur coastal area, they have yet to gain back their historic ranges in any significant way. Some biologists believe that the southern sea otter population should have reached its historic carrying capacity of about 16,000 individuals by the late 1940s. Why southern sea otter populations have not rebounded as expected is of great concern to scientists, and has sparked much discussion and research.

A noticeable decline in the southern sea otter populations between the mid-1970s and mid-1980s is thought to have been related to gillnet fishing practices. A ban on gillnetting in near coastal waters during the mid-1980s was followed by an increase in otter numbers until about the mid-1990s. Since about 1995, population

numbers have fluctuated between 2,500 and 2,700 individual otters, with a fairly dramatic increase in population numbers in 2004. However, sea otter numbers have shown a slight decrease since 2004; see USGS Press Release, 6/27/06. This fairly stagnant trend in population growth, according to some scientists, is related to a number of infectious diseases that have been causing greater-than-expected mortality in the southern sea otter population; see "Diseases Affecting Sea Otters" discussion below.

Ecosystem Requirements

Sea otters are a near-shore species, occupying various coastal marine habitat areas, including areas dominated by rocky substrate and kelp beds, nearshore sandy bottom areas, and, less frequently, offshore, deep-water areas. It is thought by many scientists that kelp beds are the primary habitat for sea otters because that is where their preferred food items occur, and also because kelp beds provide refuge from predators (primarily sharks) and inclement oceanographic conditions. Sea otters also occur in protected coastal areas, such as harbors, natural coves and embayments.

Sea otters have high metabolic rates and are known to eat up to 25 percent of their body weight per day in shellfish and other prey

items, causing otters to spend much of their time/energy searching for food. The prey of sea otters varies considerably, with urchins, crustaceans (crabs and lobsters), abalone and other marine snails dominating their diet. Most of the prey items consumed by otters occur in kelp beds and/or rocky subtidal habitats. However, some otters prey on organisms that are associated with sandy-bottom habitats, such as burrowing worms, bivalve clams, and sand dollars. In fact, researchers have recently discovered that some individual otters specialize in selecting sandy-bottom animals as their main source of food.

Mobility/Migratory Habits

According to published accounts, the movement patterns of sea otters vary both temporally and spatially. Sea otters can show marked movement over extensive geographic areas (hundreds of kilometers), both within and between annual periods. On the other hand, some individual otters (and groups of otters) exhibit much more limited movements (less than ten kilometers), and prefer to stay within a specified geographic location for extended periods of time (weeks to months). Most scientists agree that the reasons for such variation in sea otter movement/mobility relate to life-history, reproductive, and resource requirements, and, to some

extent, where individual sea otters occur within their geographic range. For example, researchers have shown that sea otter movement patterns differ between the southern and northern portions of their range in California, with animals in the south moving greater distances more frequently. Also, movement patterns differ between the sexes, as male otters have a tendency to move much greater distances than female otters over an annual period. Conversely, on a shorter time scale (days to weeks), female otters can show greater movement than territorial male otters.

Dr. M. Tim Tinker of the University of California at Santa Cruz has studied radio-tagged otters all along the California coastline, including offshore areas of Estero Bay. According to Dr. Tinker, some individual otters, and at some times groups of otters, have been observed to feed and rest in open water areas near the subject discharge area (pers. comm). These otters tend to be predominantly male. Based on radio-telemetry data, it appears that individual animals can utilize these waters for extended periods of time, from weeks to months. Many of these animals are juveniles, but some are adult males that defend breeding territories elsewhere and make periodic forays to Estero Bay. Observations of foraging patterns suggest that infaunal bivalves (clams) and crabs (of the genus

Cancer), acquired from soft bottom habitats in Estero Bay, represent a significant source of food for these otters. Dr. Tinker hypothesizes that the relative numbers of sea otters present in Estero Bay varies in response to fluctuations in the abundance and accessibility of "high-value" prey species, particularly cancer crabs.

Based on the movement and feeding behaviors of sea otters in the vicinity of the discharge, as reported by Dr. Tinker, EPA believes that there exists the possibility that some otters may come into contact with the subject discharge for unknown periods of time.

Diseases Affecting Sea Otters

Researchers over the last decade or so have identified a number of biological pathogens that are responsible for sea otter disease and mortality. These include, but are not limited to:

Toxoplasma gondii encephalitis,
acanthocephalan parasitic infection,
coccidioidomycosis (fungal pneumonia),
Sarcocystis neurona encephalitis, and
domoic acid intoxication.

Encephalitis, caused by *T. gondii* and *S. neurona,* is thought to be one of the major causes of sea otter mortality during the last decade. Shark predation is also a major source of mortality, but some researchers suggest that diseases such as encephalitis exacerbate this type of mortality by impairing an otter's ability to avoid/escape shark predation.

T. gondii requires a cat's digestive system to complete its life cycle, whereupon millions of *T. gondii* eggs (oocysts) can be shed into the environment by one individual cat via its feces. Cats of all species and types (i.e., wild, domestic, and feral) are known to be the primary host of *T. gondii.* Cats primarily acquire this parasite by consuming the tissues of other infected animals, mainly birds and rodents. It is thought that animals such as birds, rodents and sea otters acquire the *T. gondii* infection through accidental ingestion of oocysts occurring in soil and water, or by ingesting diseased tissues themselves.

According to researchers, infected cats shed oocysts for a relatively limited period, only 2-3 weeks. But how often a cat will shed oocysts, and how many times within its life, is not

certain. Through laboratory experiments, the oocysts of *T. gondii* have been found to be resilient to many different environmental conditions and extremes. However, the probable and proportional viability of oocysts (once they are shed into the environment) is unknown to researchers at this time.

Once *T. gondii* oocysts hatch inside of a host organism, an intermediate stage known as a "zoite" makes it way to the host's muscle and brain tissue (via blood and lymphatic systems) where it forms cysts. It is this "cyst" stage which causes disease and impairment in infected organisms.

Instead of using a cat as a host, but acting in much the same manner as *T. gondii*, *Sarcocystis neurona* uses an opossum (*Didelphis virginiana*) to complete its life cycle. This parasitic protozoan also causes encephalitis in sea otters. Several bacterial organisms also cause disease and mortality in sea otters, including strains from *Salmonella, Shigella, Giardia and Clostridium;* all are associated with feces of warm-blooded, terrestrial animals. In addition to these protozoan and bacterial pathogens, harmful algal blooms (which can cause domoic acid toxicity) have caused mortality events in a number of marine mammals and birds, and are thought to

have caused a significant mortality event in southern sea otters in 2003 (see "Domoic Acid Toxicity" discussion below).

Lastly, recent research has shown that the livers of sea otters from California contain among the highest concentrations of perfluorinated compounds, namely perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA); see Kannan et.al., 2006. How these compounds become bio-available to sea otters is not known, nor is the discrete origin of these compounds and how they end up in the marine environment fully understood.

Domoic Acid Toxicity

Coastal upwelling and river runoff are thought to be the major contributing factors that promote toxic blooms of *Pseudo-nitzschia*, a species of diatom common along the west coast of the United States. This species of diatom, along with others belonging to the same genus, are known to produce the neurological toxin domoic acid ("DA") when specific environmental conditions occur. For example, scientists have found that blooms of *Pseudo-nitzschia* usually occur in concert with coastal upwelling events along the California coastline. Such events (and blooms) are geographically widespread, usually affecting hundreds of miles of coastline at a time; see

Blooms of *Pseudo-nitzschia* and domoic acid in the San Pedro Channel and Los Angeles harbor areas of the Southern California Bight, 2003-2004. (2007) A. Schnetzer et.al. When DA accumulates in filter feeding animals, such as some fish, crustaceans and bivalves, it can lead to sickness and death in animals (birds, seals, otters, and humans) that feed on filter feeding animals.

Most scientists who study DA believe that high nutrient loading from terrestrial sources plays an important role in promoting toxic blooms of *Pseudo-nitzschia*. Such sources can include storm water runoff, input from natural freshwater bodies (e.g., streams, creeks and rivers) and municipal sewage ocean outfalls. Others theorize that land-based sources play a minor role in the occurrence of DA, and that periodic toxic phytoplankton blooms are driven mostly by natural processes. Linking such sources to distinct occurrences of DA in coastal waters has yet to be accomplished, and therefore a universally acceptable theory explaining these toxic events has not achieved concurrence by marine scientists who study this phenomenon.

EPA is not aware of any studies or scientific information that have linked coastal occurrences of DA to inputs from land-based sources,

including municipal sewage outfalls. EPA contacted Dr. David Caron of USC, a leading expert in the study of DA, to seek his opinion with regard to the Morro Bay/Cayucos discharge and its potential to cause and/or contribute to occurrences of DA along the central coast of California. Dr. Caron stated that the subject discharge has a potential role in DA occurrences along the central coast, however such a link (if real) would be very difficult to prove given the spatial, temporal, biological and physical complexities associated with *Pseudo-nitzschia* blooms and DA (pers. comm.).

Strandings and Mortalities

Over the past several years, government and academic researchers have conducted efforts to identify the various contributors to otter mortality by collecting and analyzing dead and sick otters, and to track where dead and sick otters have been found. The tracking and collection of sea otter carcasses is coordinated through a multi-agency effort which relies, in part, on public participation for reporting purposes. Numerous postmortem analyses (i.e., necropsies) have been conducted by government and academic pathologists on beachcast otters that meet specific criteria.

Findings reported by Kreuder et.al. (2004) indicate that Monterey

Bay and Estero Bay (Morro Bay and Cayucos) have the greatest number of beachcast otters within the geographic range of where beachcast otters were collected. Likewise, Miller et. al. (2002) draw similar conclusions based on the data and methods used by Kreuder et.al.(2004). Much of the information used in both studies derived from beachcast otters collected during 1998-2001. A majority of the beachcast otters analyzed for these studies showed that diseases caused by pathogenic organisms, such as *T. gondii*, Acanthocephalan parasites, and *Sarcocystis neurona*, were likely the primary cause of death.

Some have construed/interpreted the results of these two studies to indicate that the Monterey Bay and the Morro Bay areas are epicenters for sea otter disease, sickness, and death. Both studies, however, indicate that the documenting of beachcast otters is a function of shoreline access by humans. That is to say, coastal areas that are remote and not easily accessible to persons have fewer (or no) documented incidences of beachcast otters. In contrast, coastal areas that are accessible, such as sandy beaches in the vicinity of urban areas, showed the greatest number of documented beachcast otters. Accordingly, both Monterey Bay and Estero Bay proved to have the greatest numbers of beachcast otters

documented relative to other areas within the southern sea otter range. Areas such as the Big Sur coastline, and the coastal stretch between Pt. Sal and Pt. Conception, had few (if any) reportings and collections of beachcast otters. Thus, results provided by these studies are skewed toward sandy beaches that are more easily accessed by the public. EPA believes that this bias undermines the contention that the Monterey and Morro Bay areas are epicenters (within the southern sea otter's geographic range) for sea otter disease, sickness, and death.

It is also important to note that the fact that a diseased otter is found at a particular geographic location does not necessarily lead to the conclusion that the location itself is where the otter acquired a pathogen and/or disease. Most of the pathogens that cause sickness/disease in otters can take months, and sometimes years, to cause serious impairment and death in otters. EPA's review of the available literature found no evidence that provides that beachcast otters are acquiring disease-related pathogens from the same geographic areas in which they are found. Further, some scientists point out that the drifting of otter carcasses on ocean currents could be a significant factor influencing beachcast location. Depending on the time of year, ocean conditions, and

prevailing wind and water currents, a floating sea otter carcass may float 50-100 miles within a 2-4 day period. This suggests that there may be considerable geographic distance between where a beachcast otter is reported/found and where an otter becomes impaired or dies from infectious pathogens.

Toxoplasma gondii, Disposable Cat Litter, and the Morro Bay/Cayucos WWTP

It has been suggested that the subject wastewater treatment facility may be contributing to *T. gondii* infections in sea otters by way of "flushable" cat litter. This is because some pet owners dispose of cat feces (from home litter boxes) to their toilets. In theory, once cat feces are placed into the sewer collection system, oocysts from the feces pass through the wastewater treatment facility and are released into the marine environment by way of the facility's ocean outfall. Once in the marine environment, the oocysts are available to infect marine mammals such as the southern sea otter.

Most of the analytical research concerning the detection of *T. gondii* oocysts in water has been conducted in relation to drinking water quality. Like other protozoan pathogens, such as *Giardia* and

Cryptosporidium, *T. gondii* poses a significant human health risk, and its occurrence in drinking water has been investigated by a number of public health agencies and academicians. Analytical methods used to determine the presence of *T. gondii* oocysts in drinking water involve extensive filtration, centrifugation, sporulation of oocysts, mice inoculation and infection periods (up to 60 days), followed by necropsy and tissue analyses; see Villena et.al, 2004 for details. Similar analytical methods for detecting the presence of *T. gondii* in wastewater and bivalve tissues are not available. In fact, there are no validated assays ~~for~~ rapid detection of T. gondii oocysts in the environment (i.e., soil, water, air). Assay techniques that combine the use of filtration, immunomagnetic separation (IMS) and direct fluorescent antibody (DFA) detection are under development by the Conrad Lab at UC Davis. However, final development of both the IMS and DFA techniques are dependent upon the development and production of monoclonal antibodies used to concentrate intact oocysts from water and tissue samples. This scientific work is in progress, but will require substantial effort and time to complete. Thus, it is not currently possible to ascertain whether or to what extent *T. gondii* oocysts occur in wastewater, storm water run-off, or natural water bodies such as streams, creeks, lakes, or the ocean.

It is currently not known if oocysts are transiting through the subject facility and entering the local marine environment by way of the outfall. This is primarily due to the lack of an analytical method to determine oocysts from wastewater. Once a viable, analytical method is developed, it should be possible to determine the relationship between differing treatment levels (primary, secondary, and tertiary) and the amounts/occurrences of oocysts in wastewater.

UC Davis Research Results

Recent research conducted by the University of California at Davis (UC Davis) has shed light on the estimated amount of cat feces being disposed of into the Morro Bay/Cayucos community sewer system (by pet owners), and the relative amount of feces and *T. gondii* oocysts deposited outdoors by both feral and domestic cats in the same area. Two research papers, one published and the other submitted for publication, detail these research efforts and results:

> "Outdoor fecal deposition by free-roaming cats and attitudes of cat owners and non-owners toward stray pets, wildlife, and

water pollution". H.A. Dabritz et.al. J. Am. Vet. Med. Assoc. 2006; 229: 74-81.

and

"Detection of Toxoplasma gondii oocysts in cat feces and estimates of the environmental oocyst burden in a California coastal community" Submitted for publication to J. Am. Vet. Med. Assoc. by H.A. Dabritz et.al., March 2007.

Using a cross-sectional survey design, UC Davis researchers (Dabritz et. al. 2006) conducted a telephone survey in 2002-2003 involving households in the Morro Bay, Cayucos and Los Osos communities; results from Los Osos have been excluded here since the entire Los Osos community is not sewered. In part, the survey attempted to estimate: 1) total cat population for the area (both feral and non-feral cats); 2) amount of outdoor fecal deposition by cats; and 3) amount of cat feces deposited into toilets/sewer by cat owners.

According to the Dabritz et.al., there are an estimated 6,393

households in the Morro Bay/Cayucos area. Study results indicate that the ratio of domestic cats to the number of total households in the area is 1:2, or about 3,500 domestic cats in the area. According to pet-owners, 44% of domestic cats defecate outside/outdoors most of the time (75% of the time). UC Davis researchers extrapolated these results to approximate that 34 tons of cat feces are deposited in the Morro Bay/Cayucos watershed on an annual basis, or about 205 lbs per day; the daily amount of fecal deposition for a cat was estimated via a separate study conducted by the UC Davis team, and was used for extrapolation purposes in the subject study.

Additional results from this UC Davis research indicate that over 700 feral cats live in the Morro Bay/Cayucos area. Assuming these animals defecate outdoors 100% of the time, approximately 10 tons of feces are deposited by feral cats in the Morro Bay/Cayucos watershed on an annual basis, or 60 lbs per day.

The combined amount of "outdoor" feces from both domestic and feral cats being deposited in the Morro Bay/Cayucos watershed on an annual basis approximates 44 tons, or 265 lbs per day; although not considered here, the contribution from local wild cats, such as

bobcats and mountain lions, is likely negligible given their small population numbers.

Six and a half percent (6.5%) of the cats identified in the survey had their feces collected from litter boxes by pet owners and disposed to the toilet. This represents approximately 2.2 tons of cat feces annually, or 13 lbs per day, which is disposed of to the municipal sewage treatment facility.

Additional research conducted by UC Davis (Dabritz et al. in press) analyzed 326 cat fecal samples (scat) from the same study area for *T. gondii* oocysts. Samples were collected from the Morro Bay, Cambria, Cayucos and Los Osos areas between July 2003 and August 2005 and were obtained from various places, including cat shelters, veterinary clinics, submittals from cat-owning households, and field scat. Oocysts were detected in only three (3) of the 326 samples analyzed, which is less than one percent of the total sample size. Results of this research suggest that, based on the estimated tonnage of cat feces deposited outdoors in the sample area and the estimated number of oocysts per scat, the annual number of oocysts shed to the local environment could be three (3) billion. UC Davis researchers note that three billion is a

conservative estimate and that additional calculations/extrapolations suggest that as many as 145 billion oocysts could be shed to the environment. Based on an estimated watershed size of 7,672 acres, Dabritz et. al. (in press) concludes that there can be between 9-434 oocysts for each square foot of local watershed; these research conclusions assume the duration of time in which cats are infected with *T. gondii* and the number of oocysts shed per infected cat.

Of the 326 cat fecal samples analyzed in the Dabritz et. al. (2007) research, the three samples which showed positive for oocysts came from cats which spent all or a portion of their life outdoors.

UC Davis research concludes that there is significantly more fecal deposition by cats outdoors than that being placed into the municipal sewer system by pet owners. Consequently, the magnitude of *T. gondii* oocysts originating from watershed and/or land-based sources is significantly higher than any potential contribution of oocysts from the municipal ocean outfall.

Although the subject wastewater treatment plant cannot be ruled out as a potential contributor of *T. gondii* oocysts to the local marine

environment, EPA finds that any potential contribution would be insignificant when compared to the number of potential oocysts deposited directly in the watershed by outdoor cats. This finding is primarily based on the research conducted by the UC Davis team.

Determination

Much of the available research indicates that the southern sea otter population is not doing well. Most researchers agree that one of the major factors affecting sea otter health and recovery is infectious disease, primarily caused by biological pathogens. Recent investigations indicate that *T. gondii* is a significant player in sea otter mortality. This parasitic pathogen requires terrestrial hosts (exclusively felids) to complete its life-cycle, and likely enters the marine environment (in the oocyst stage) via fresh water inputs. Most researchers believe that streams, creeks, and storm drains, rather than sewage outfalls, provide the primary mechanism for transport of *T. gondii* oocysts to the marine environment. This is based on the fact that significantly greater amounts of cat feces are deposited outdoors in the local watershed than those placed into the municipal sewer system by pet owners. Further, though the potential for contribution from the municipal sewer system exists, there is no evidence to support a finding that

the subject discharge releases any measurable quantity of oocysts into the marine environment. For these reasons, EPA believes that the subject wastewater treatment facility is, at most, an insignificant contributor of *T. gondii* oocysts to the marine environment.

EPA's search of current and historic information (scientific and commercial) has yielded no studies or data to indicate that the wastewater discharge from the subject facility has had a detrimental impact on the southern sea otter. In addition, EPA is not aware of any information that indicates that the subject facility has a reasonable potential to adversely affect the southern sea otter. Further, EPA has proposed, and the applicant has agreed to implement, conservation measures (described in detail above) that would minimize any potential adverse effect on the southern sea otter from the subject discharge.

In light of the above, it is EPA's determination that the continued wastewater discharge from the Morro Bay/Cayucos Treatment Plant is not likely to adversely affect the southern sea otter.

Sources

An unusual genotype of *Toxoplasma gondii* is common in California Sea Otter (*Enhydra lutris nereis*) and is a cause of mortality. International Journal for Parasitology 34 (2004) 275-284. M.A. Miller et.al.

Association between Perfluorinated Compounds and Pathological Conditions in Southern Sea Otters. Environ. Sci. & Technol. Published on the Web 07/15/2006. K. Kannan et. al. --

Biological analysis of sea otters and coastal marine ecosystems in Central and Southern california: Synopsis and update. White Paper, 31 March 2006. 17 pages. J. Estes et.al.

Blooms of *Pseudo-nitzschia* and domoic acid in the San Pedro Channel and Los Angeles harbor areas of the Southern California Bight, 2003-2004. Harmful Algae (2007)doi: 10.106/j.hal.2006.11.004. A. Schnetzer et.al.

Brown Pelican, USFWS Endangered Species Fact Sheet. April 2002.

California Sea Otters - 2006 Survey Numbers Dip But Overall Population Trend Remains Up. USGS Press Release, 6/27/06

Coastal freshwater runoff is a risk factor for *Toxoplasma gondii* infection of southern sea otter (*Enhydra lutris nereis*). International Journal for Parasitology 32 (2002) 997-1006. M.A. Miller et.al.

Detection of *Toxoplasma gondii* oocysts in drinking water. Applied and Env. Microbiology, June 1988, p. 2278-2280. J. Issac-Renton et.al.

Detection of Toxoplasma gondii oocysts in cat feces and estimates of the environmental oocyst burden in a California coastal community. Submitted for publication to Journal of American Vet. Med. Assoc. by H.A. Dabritz et.al., March 2007.

Evaluation of an indirect fluorescent antibody test (IFAT) for demonstration of antibodies to *Toxoplasma gondii* in the sea otter (*Enhydra lutris*). J. Parasitology, 88(3), pp. 594-599. 2002 M.A. Miller et. al.

Evaluation of a strategy for *Toxoplasma gondii* oocyst detection in water. Applied and Env. Microbiology, July 2004, pp. 4035-4039. I. Villena et.al.

Fall 2005 Mainland California Sea Otter Survey Results. 9 December 2005. US Dept. of Interior, USGS, Western Ecological Research Center. B. Hatfield

How to detect *Toxoplasma gondii* oocysts in environmental samples? FEMS Microbiology Reviews 27 (2003), 651-661. A. Dumetre et.al.

Molecular and bioassay-based detection of *Toxoplasma gondii* oocyst uptake by mussels (*Mytilus galloprovincialis*). International Journal for Parasitology 33 (2003) 1087-1097. K. Arkush et.al.

Outdoor fecal deposition by free-roaming cats and attitudes of cat owners and nonowners toward stray pets, wildlife, and water pollution. JAVMA, Vol 229, No.1, July 1, 2006. H.Dabritz et. al.

Patterns of Mortality in Southern Sea Otters (*Enhydra lutris nereis*) from 1998-2001. J. of Wildlife Diseases, 39(3), 2003, pp.

495-509. C. Kreuder et. al.

Patterns of seabird and marine mammal carcass deposition along the central California coast, 1980-1986. Can. J. Zool. 69: 1149-1155. J.L. Bodkin et.al.

Peregrine Falcon, USFWS Endangered Species Fact Sheet. May 2006.

Population Dynamics and biology of the California Sea Otter (*Enhydra lutris nereis*) at the southern end of its range; Final Study Report. U.S. Dept. of Interior, Minerals Management Service. OCS Study MMS 2006-007. Prepared under MMS Cooperative Agreement No. 14-35-0001-31063. 239 pp.

Southern sea otters (*Enhydra lutris nereis*) and emergent disease in the near shore environment: Assessment of spatial trends in cause-specific mortality from 1998-2001 and evaluation of an aerial survey method for surveillance of trends in mortality. Coastal Environmental Quality Initiative. 2004. Paper 005. C. Kreuder.

Southern Sea Otter as a Sentinel of Marine Ecosystem Health. EcoHealth 1, 239-245, 2004. D. Jessup et.al.

Spring 2005 Mainland California Sea Otter Survey Results. 6 July 2005. US Dept. of Interior, USGS, Western Ecological Research Center. B. Hatfield.

TDD: City of Morro Bay/Cayucos Sanitary District, Application For a Modified NPDES Permit Under Section 301(h) of the Clean Water Act; Tentative Decision of the Regional Administrator. U.S. EPA, Region IX, 11/10/05.

The 2003 southern sea otter (*Enhydra lutris nereis*) unusual mortality event: A preliminary report to NOAA and USFWS. 10 pp. D. Jessup et.al.

Toxoplasma gondii, Neospora caninum, Sarcocystis neurona, and *Sarcocystis canis*-like infections in marine mammals. Veterinary Parasitology 116 (2003) 275-296. J.P.Dubey et.al.

Transmission of Toxoplasma: Clues from the study of sea otters as sentinels of *Toxoplasma gondii* flow into the marine environment. International Journal for Parasitology 35 (2005) 1155-1168. P.A.Conrad et.al.